fishes. This great group includes nearly two-thirds of all fresh-water fishes and comprises the Characinids of America and Africa, the Gymnotids of America, the Cyprinids of the northern hemisphere and the various families of Nematognaths. These groups, in most systematic works, have been widely separated and severally associated with forms with which they have no intimate relationships. As long as such views prevailed, the appreciation of the great importance of the geographical distribution of the groups was concealed from view. But with the recognition of the unity of organization, and, consequently, unity of origin of the whole, a fresh conception of the relations of that whole to the faunas of the present and past breaks in upon us. We are now justified, from the morphological data at hand, in claiming that all the groups enumerated as OSTARIOPHYSI and belonging to the orders PLECTOSPONDYLI and NEMATOGNATHI are naturally segregated and not closely related to any existing aboriginal marine types. The marine forms of the family *Plotosidæ* and the siluroid sub-family *Tachisurinæ* must be regarded as divergents from fresh-water forms. With this assumption it becomes necessary to postulate that all the numerous families of the Plectospondylous and Nematognathous orders are derivatives from primitive fresh-water types. The extent of this divergence may be inferred from the numerous morphological modifications. The antiquity of the origin of the superorder must be commensurate with the extent of divergence. Far from originating in the advanced tertiary, it is not unreasonable to infer that the parent stock had become acclimatized in the fresh water as far back as the early mesozoic; instead of the parent land being the Himalaya region or highlands of Asia, as claimed by Dr. Günther, it is much more likely to have been in the southern hemisphere—possibly an antarctic continent. At any rate, the present geographical distribution of the representatives of the respective orders seems to render such an origin most probable. The reasons were given in detail.

The distribution of the group thus outlined is to some extent collateral with that of certain mollusks and crustaceans, and the facts respecting the range of the unionaceous bivalves and the ostracod crustaceans were especially discussed.

It is quite true that there is no paleontological evidence for the inferences and assumptions thus made, but this is simply because the geological record is wofully imperfect and many of the changes took place in continental areas now submerged or little explored. No remains of Ceratodontids, which must of course have lived to continue the line from the Jurassic species to the present, have been found. The same conditions that have affected the one must have prevailed for the others.

DRY DREDGING IN THE MISSISSIPPIAN SEA.

THE U. S. National Museum has recently secured large collections of Devonian fossils, chiefly corals, from New York, Ontario and Michigan. The first casts were made in the Corniferous limestone in the vicinity of LeRoy, New York, where the cherty limestone underlying the quarry layers is charged with an abundance of corals, the net sometimes having masses of *Diphyphyllum* of more than a hundred pounds weight. At Williamsville, near Buffalo, corals are also plentiful, but here the fauna is smaller and the species are not so common as at LeRoy. However, a short distance west of Buffalo, to the north and west of Port Colborne, in Ontario, well-preserved Corniferous corals are present in great variety and abundance. Also at Hagersville, large masses of various compound species are numerous, many hundred tons of which, two years ago, were broken up

and used for road making. At all the localities mentioned, except Williamsville, the corals are in a siliceous pseudomorphous condition; *i. e.*, the original carbonate of lime has been replaced by amorphous silica. The surrounding limestone being so much softer, on weathering it decomposes far more rapidly than the included chert bands and corals, and leaves them lying loose in the soil or among the flakes of chert thrown up by the farmer's plow. Collecting places are usually easily discovered, since outcrops of the Corniferous limestone are generally indicated by stone walls surrounding the farms or by stone piles scattered over them. Four miles west of Port Colborne, at one of Prof. Nicholson's localities, there is a rock pile more than fifteen feet high, every piece of which contains corals or mollusca. At such places, one is interested often for days in turning over the rocks and selecting the better specimens, all of which can, if necessary, be further developed with dilute hydrochloric acid.

Towards the western portion of Ontario, at Thedford, the next younger, or Hamilton, formation is well exposed, and here again corals are very abundant. This locality is probably the most famous for Middle Devonian fossils in North America, and visiting collectors will find themselves pleasantly surrounded with people who understand that a collector of fossils is neither a curio collector nor insane. It is painful to have the same question asked many times each day: "Mister, what are you looking for?" and after one has explained, to observe in the listener no comprehension of the first principles of geology, or, worse, to be told: "I suppose you take them home and gild them." But at Thedford one is either left alone or assisted to find localities, or, better still, allowed to collect in the cabinets of the minister, teacher, storekeeper, tailor, or section boss. What a splendid place Thedford is to the collector of fossils can be surmised on stating that from one to five thousand specimens of the brachiopod *Spirifer mucronatus* can be picked up in a day. Thedford, formerly known as Widder, is made famous by the writings of Billings, Hall and Whiteaves, and is visited annually by collectors. Sometimes a college professor turns up with a car load of students, including ladies. The local enthusiasm, however, has been developed by the intelligent efforts of Rev. Hector Currie, who, in a village of less than one thousand inhabitants, is surrounded by four enthusiastic collectors.

The Hamilton formation is again observed on both sides of the southern peninsula of Michigan, near its northern extremity. Thunder Bay Island, situated twelve miles east of Alpena, is almost one mass of the coral-like *Stromatopora*, growing in thin concentric layers one upon another, until single colonies assume a diameter of from a few feet to the great width of three yards. Upon these the sea of Lake Huron has been pounding for ages, weathering away the top of each wavy dome and separating the colony into innumerable, concentric, fractured layers. In a general way, each mass resembles a transverse segment of a huge tree trunk, and is often taken for such by the local life-saving crew. In the quarries north of Alpena, layers of limestone nearly barren of fossils and less than ten feet thick are seen to increase rapidly to a thickness of nearly twenty feet toward the coral reef, which is built up by *Stromatoporæ*, large *Acervulariæ*, numerous compound branching corals, and here and there a shell or the beautiful calyx of a crinoid. Petoskey, on Lake Michigan, is another well-known Devonian locality, and is famous not only as a summer resort for hay-fever sufferers, but for the 'Petoskey stone' as well. This stone is usually a polished fragment of the coral *Acervularia davidsoni* or of *Favosites alpenensis*, and local

curio dealers search for them in a novel manner. This is done by sprinkling with water the pebbles on the beach of Little Traverse Bay. By the temporary polish thus produced, the dealers are enabled to gather the Petoskey stone in a nearly marketable condition for tourists.

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ANTIDROMIC PROBLEMS.

IN my paper on Antidromy* I have tried to show: (1) that there is a diversity among the individuals of every species of flowering plants, some with a tendency to dextrorse, others to sinistrorse twisting; (2) that this can be traced more or less through the different orders of plants, in the seeds, stem, phyllotaxy, anthotaxy and seed vessels; (3) that it is apparently caused in most cases by the place of origin of the anules on the right or left margin of a carpellary leaf.

The general evidence for this view is to be found at large; and without going into details, I may say that further observations confirm the conclusions first reached. The article by Professor Beal in the *American Naturalist*, 1873, with interesting notes on two kinds of spirality in the cones of the same trees of the Coniferæ, presented a difficulty when first called to my notice; but I find that the young cones are homodromic with each other and with the leaf-spirals of the Coniferous trees, whilst the older cones undergo a change by displacement of the scales, resulting in a false antidromy in the same tree. On growing maize-plants from grains taken from one column of an ear, the forthcoming plants are of different kinds. (This is to correct the statement in my former paper.)

I have not yet been able to extend the law into the higher cryptogams; though some things in ferns make me hopeful of succeeding with them, as also some of the illustrations in Schimper's Vegetable Paleontology and in other books. A few illustrations in the books are, I think, erroneous; thus Engler and Prantl give *Helicteres* (Sterculiaceæ) and with carpels *antidromic on the same plant.* I think this will be found erroneous, as I know the same work is wrong in the figure of *Erodium*, whose fruit-beaks are all and in all plants dextrorsely twisted (that is in the direction of the thread of a screw); as are those in Pelargonium. The carpels of these do not appear to be antidromic (though the leaves are so) as between different plants; and in *Impatiens*, of the same order, both carpels and leaves are antidromic. Sachs' *Botany* gives a figure with a wrong spiral for the elaters of *Equisetum* (and I confess my own sin here); they run dextrorsely in all the plants.

The spirals of the oogonium of *Chara* are always sinistrally twisted, given wrong in Dodel-port's diagram. The peristome of Barbula and other mosses, if twisted, is usually dextrorse, and the seta in opposite directions (didromic) in its upper and lower parts. I think the inner peristome of Buxbaumia is sinistrorse. The anchoring cable of *Vallisneria* is didromic, twisted dextrorsely above and sinistrorsely below, so as to bring the two ends nearer together by a central turning. The same is true of the awns of *Stipa*, *Danthonia*, and many other grasses; the base being a dextrally twined ribbon and the tip a sinistrorse seta; when it is wet the basal ribbon unwinds so as to screw the seta into the earth as into the wool of sheep or the clothing and skin of men, as Captain Cook's seamen discovered in the last century in northeastern Australia. These are cases not of true Antidromy, but of Didromy, a double twist in the same organ.

As mentioned in my former paper, *Richardia*, *Iris* and *Juncus* appear to produce antidromic plants not merely by seeds, but by

* Torrey Bulletin, September, 1895.